# Aura HIRDLS geophysical Data Validation With the Envisat MIPAS

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# Introduction

- **Purpose:**
  - **Present MIPAS as validation asset.**
  - **Outline validation strategies.**
  - **Discuss motivation.**
  - **Examples and illustrations.**
  - **Further work.**

  - **Credits and Contributors:**
    - **Oxford Univ: J. Barnett, C. Waymark, A. Dudhia**
      - **Please visit posters by C. Waymark (V7) & J. Hurley (V4).**
    - **RAL: A. Waterfall**
      - **Please visit poster by A. Waterfall (V16)**
    - **UCB/NCAR: J. Gille, B. Nardi, R. Khosravi.**
      - **Please visit posters by B. Nardi (V13), D. Kinnison (V5).**

# MIPAS and Envisat

- **Description:**
  - **The Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) was launched aboard the ESA Envisat satellite on 1st March 2002.**
  - **The orbit is polar with 98 deg inclination, is sun-synchronous 10:00 am mean local solar time on the descending node, with a repeat cycle of 35 days and altitude about 800 km.**
  - **The Aura and Envisat orbits have quite different ascending node times, but the tangent point viewing tracks cross near both poles and every few days near coincident observations occur.**
  - **HIRDLS view direction is approx 47 deg from the anti-flight direction on the anti-sun side (starboard)**
  - **MIPAS can view rearward and 90 deg anti-sun side (starboard).**

# MIPAS and Envisat

- **Description:**
  - **From Jul ’02 to Mar ’04 MIPAS operated in high resn. (0.025 cm-1) and 3km mode, ESA has processed these data to L2.**
  - **From Aug ’04 to Sep ’04 MIPAS operated at reduced resolution (0.0625 cm-1) with the same vertical resolution. ESA have processed these data to L2.**
  - **From Jan ’05 to the present MIPAS has been operated at the reduced resolution but finer vertical steps (1.5 km). Early in the period the ‘duty cycle’ was about 35% but has recently been around 80%. Very little L2 data are available from ESA.**
  - **Oxford has been producing some MIPAS L2 data from Jul ’02 to the present.**
  - **Formal validation has been published for L2 version 4.61 and 4.62. The current version is 5.0. (http://www.atmos-phys-chem-discuss.net/special_issue26.html)**
  - **Validation of the Oxford MIPAS products is on-going.**

# MIPAS and HIRDLS

- **Description:**
  - **Very little ESA L2 data are available to make comparison with HIRDLS, of the days when data are available it is often for only one or two orbits in the day.**
  - **The Oxford MIPAS L2 data were not routinely produced before June 2007, but there were more complete days of data, which makes calculating zonal averages and finding closest coincident profiles more useful. Since June 2007 Oxford is routinely producing MIPAS L2 data.**

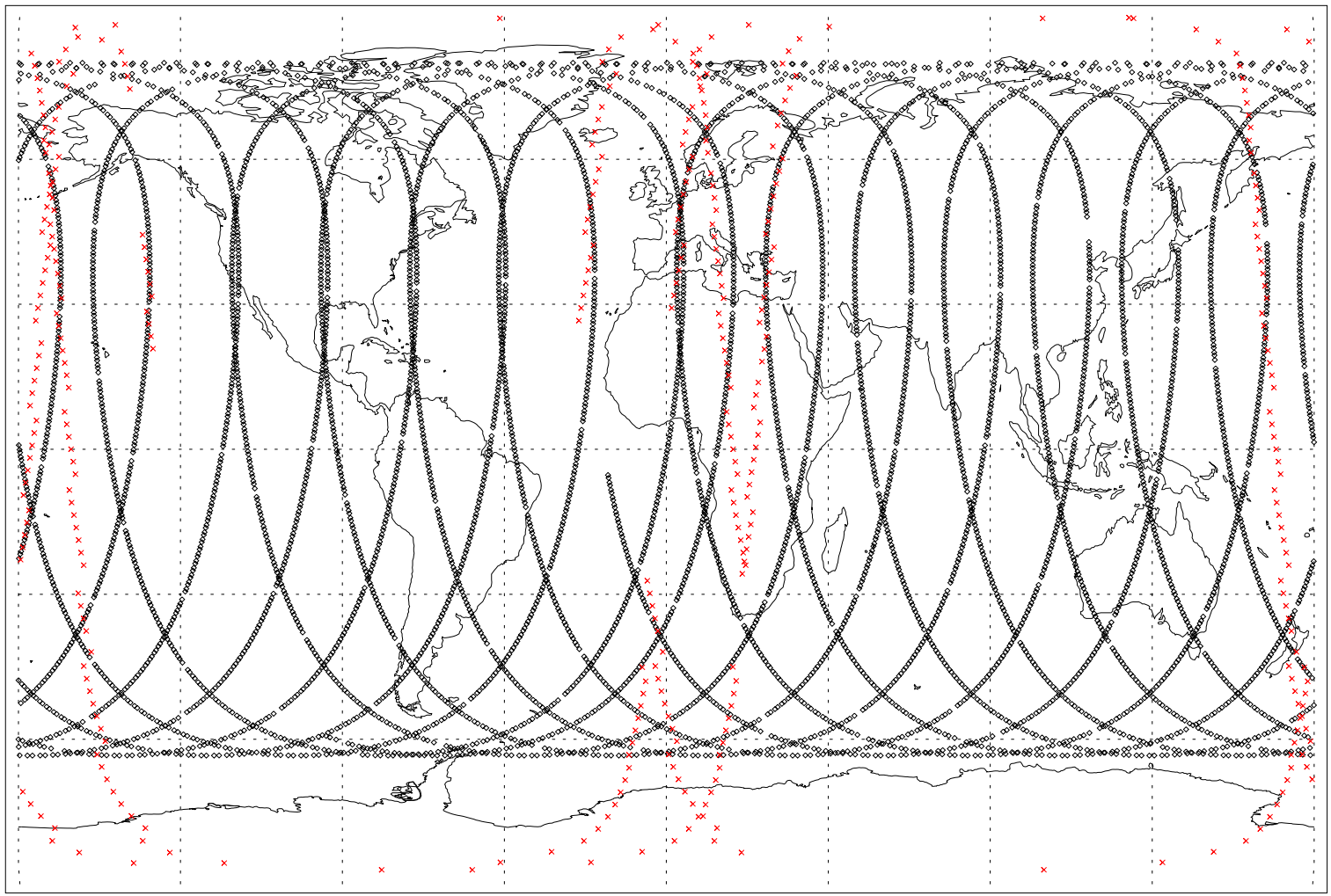
# MIPAS and HIRDLS

- **Validation by comparison**
  - **MIPAS and HIRDLS are based on obtaining the state of the atmosphere by similar methods and from similar platforms.**
  - **Very important validation is performed at the L1/L1B product level – See Claire Waymark's poster.**
  - **But differences include:**
    - **Horizontal optical paths to the same tangent location or profile.**
    - **Vertical spatial response function.**
  - **In the following methods we adopt:**
    - **Comparison of individual atmospheric profiles obtained within 1 deg great circle and 12 minutes of each other. This happens around the most poleward latitudes (see later).**
    - **Zonal averages obtained within a 24 hour period – which provides uniform longitudinal cover and averages diurnal effects.**
    - **Group close coincident pairs of profiles into latitude bands for a given day remote from the day/night terminator (non-tracers).**
    - **Use a sample of data from ESA L2 v 5.0 as initial reference then use the Oxford MIPAS L2 data henceforth.**

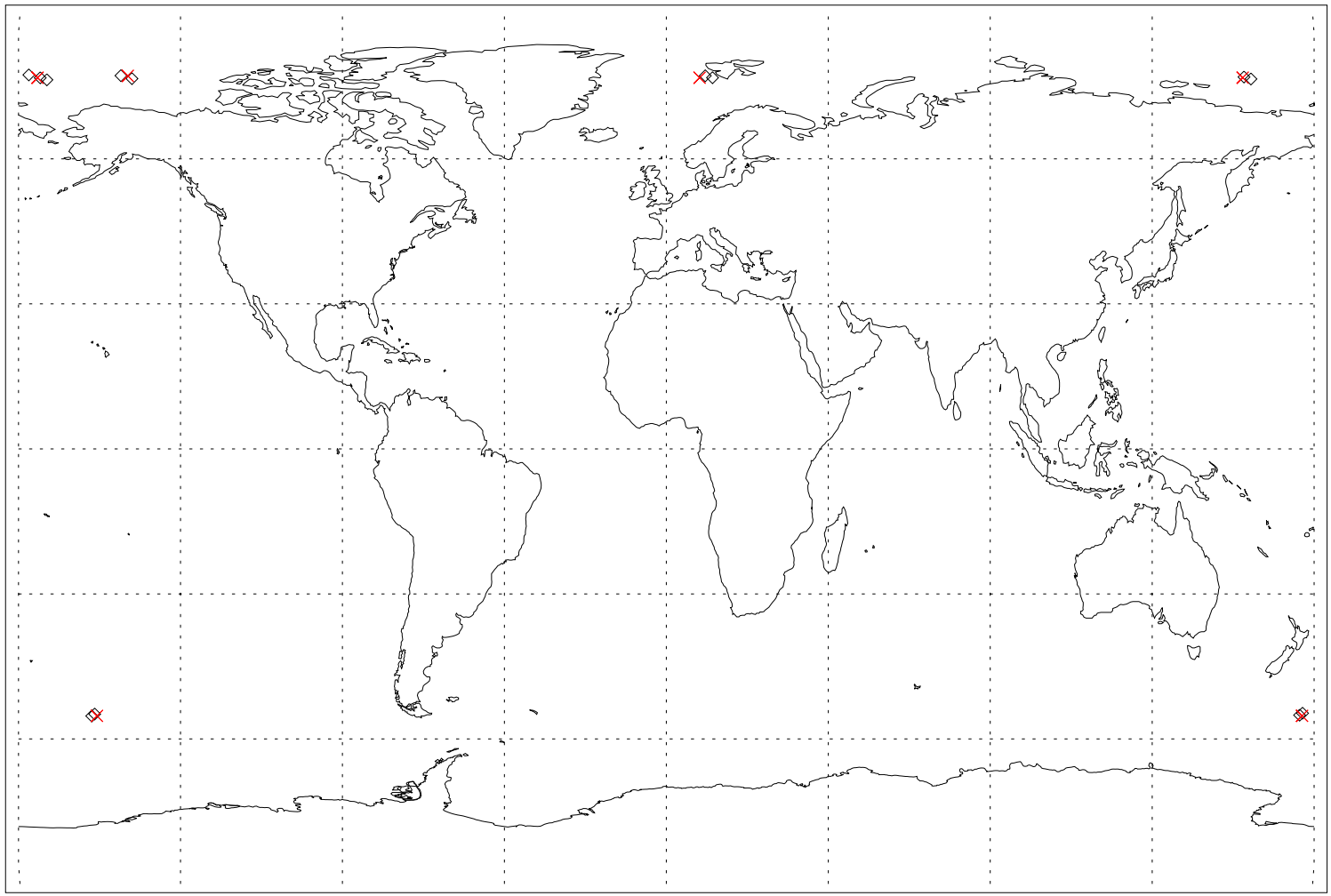
# MIPAS and HIRDLS

- **Motivation**
  - **The ESA MIPAS L2 products include species: Temp; O3, HNO3, H2O, CH4, N2O, NO2. The Oxford MIPAS L2 products include these and additionally N2O5, CLONO2, F-11, F-12.**
  - **The work includes comparison of all these products with those of HIRDLS.**
  - **Newly generated HIRDLS version 2.04.09 (internal designation) provides a bug fix to v2.04.08 associated with the correction scheme for profiles obtained during the upward scanning. Differences would not be noticeable in the current work.**
  - **MIPAS data represent a valuable asset during the on-going work to better understand and improve the correction algorithms needed to deal with the partially blocked HIRDLS telescope.**

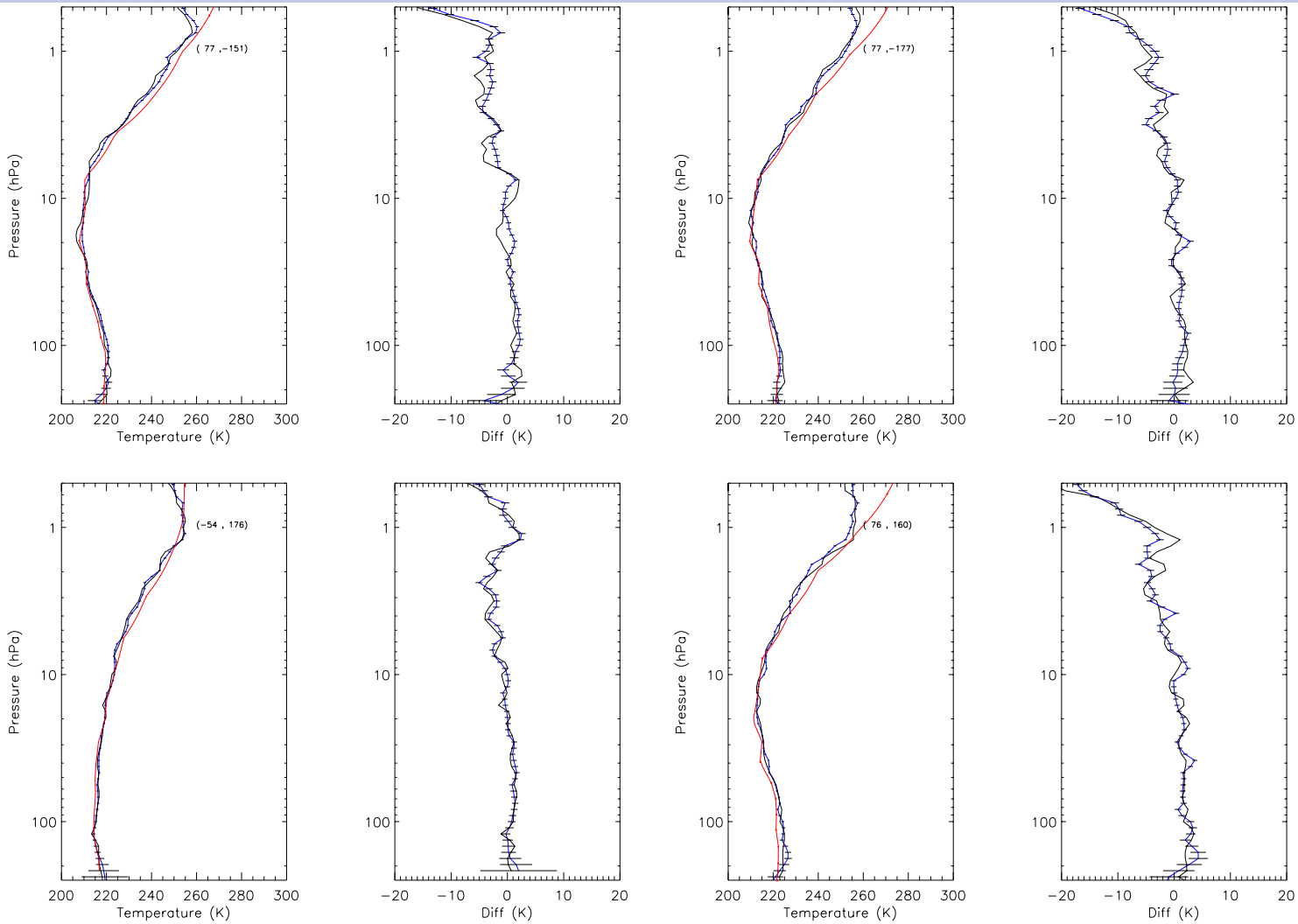
# MIPAS v5.0 and HIRDLS v20408



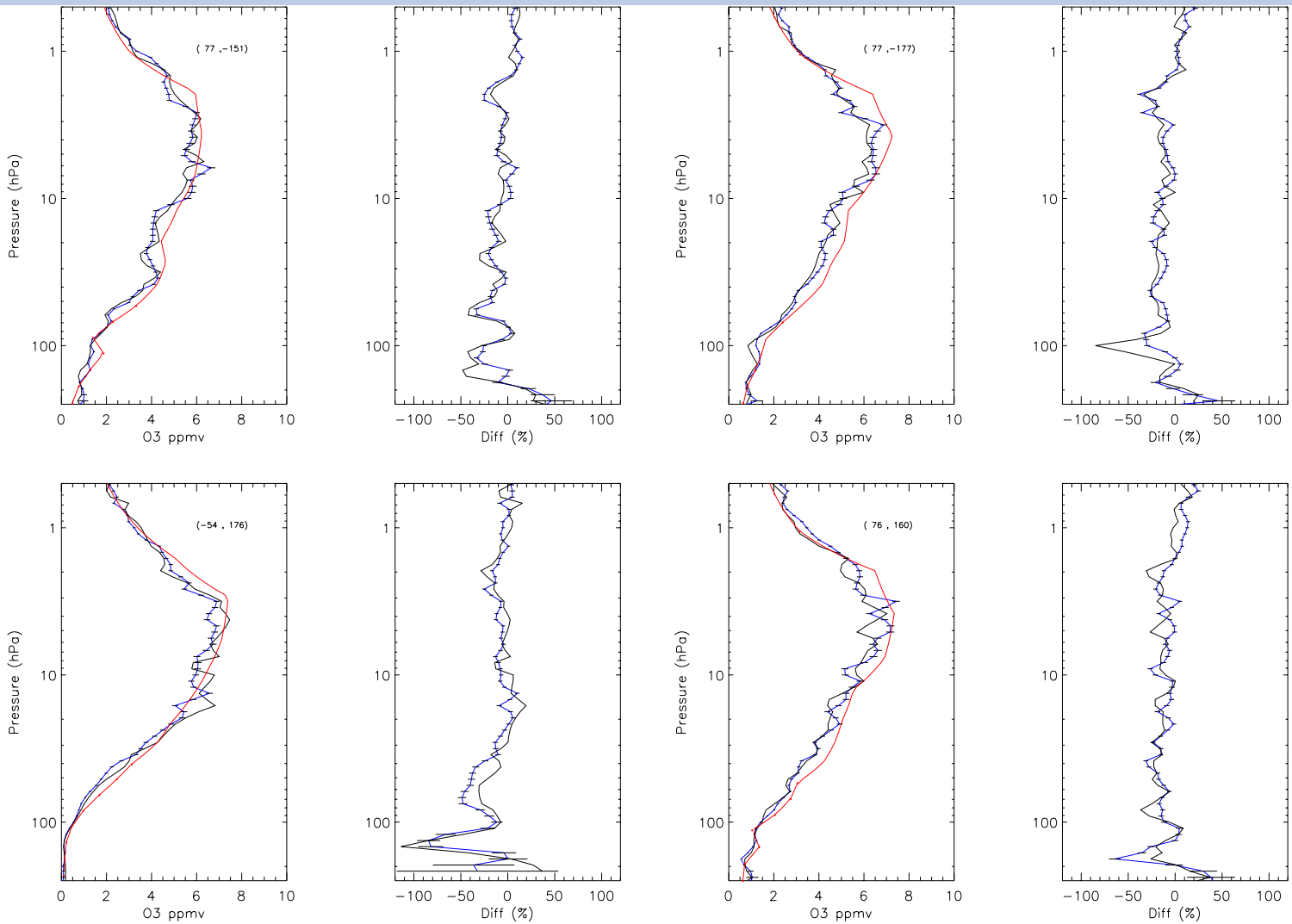
# MIPAS v5.0 and HIRDLS v20408



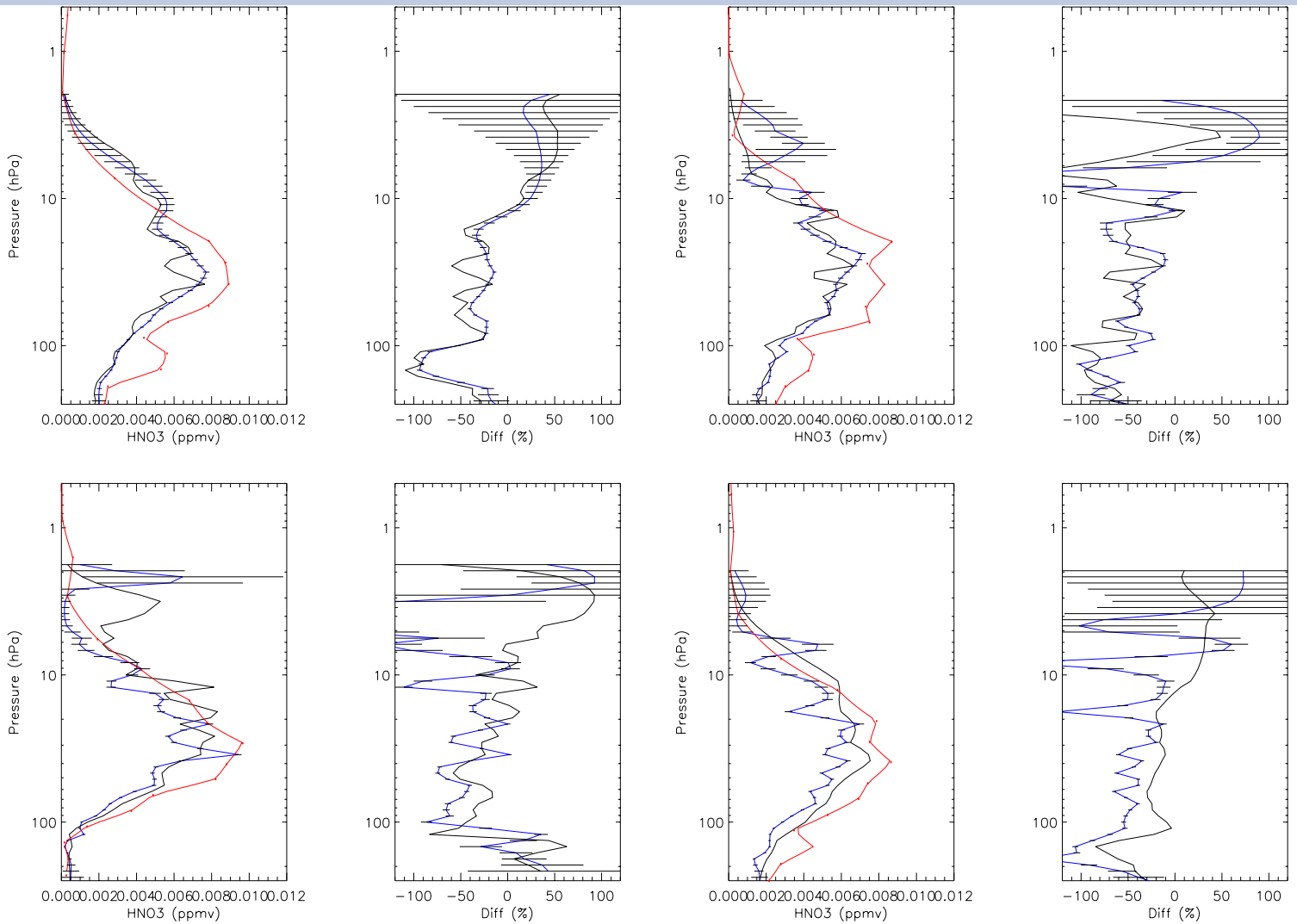
# MIPAS v5.0 and HIRDLS v20408 Temperature



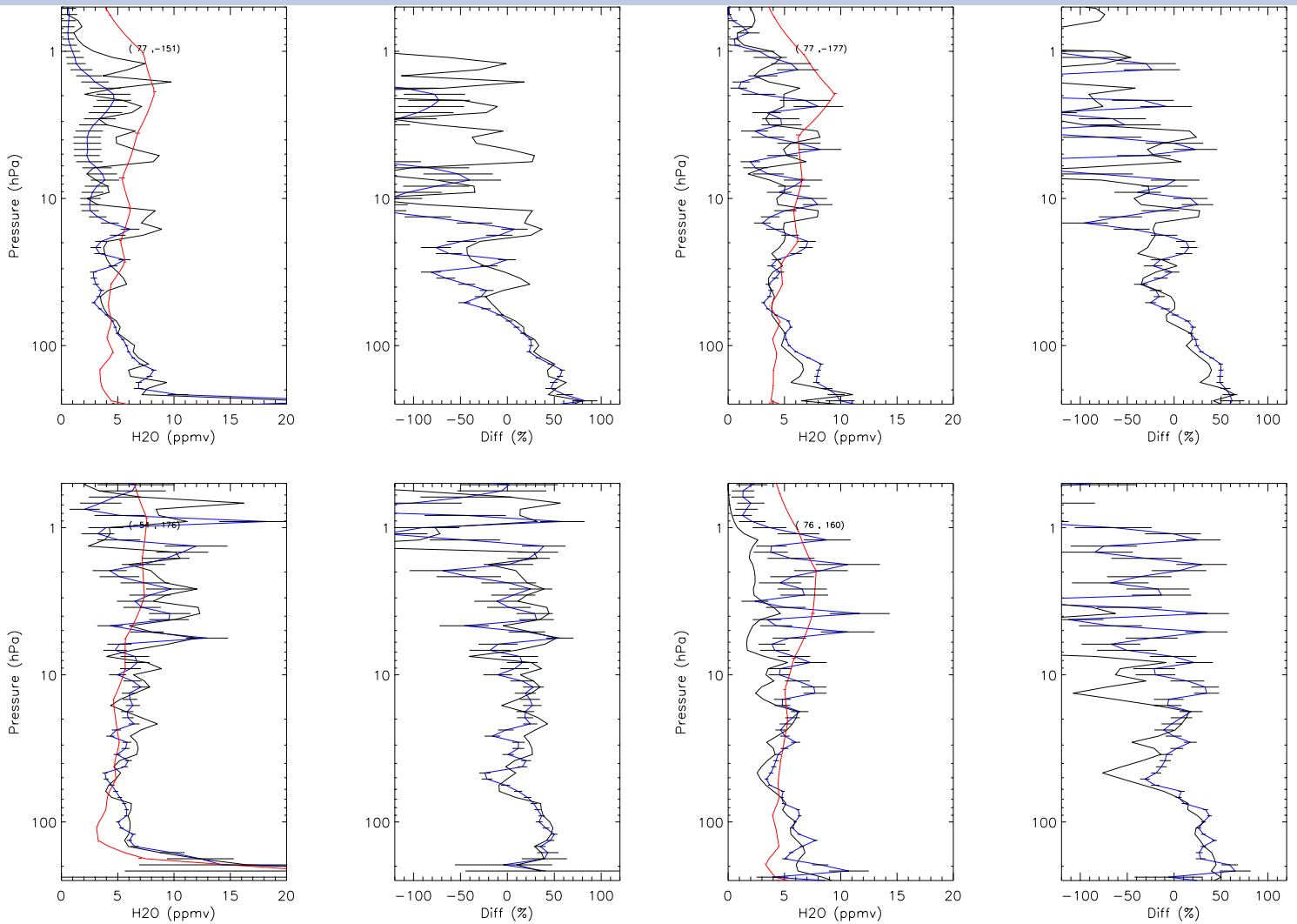
# MIPAS v5.0 and HIRDLS v20408 O3



# MIPAS v5.0 and HIRDLS v20408 HNO3

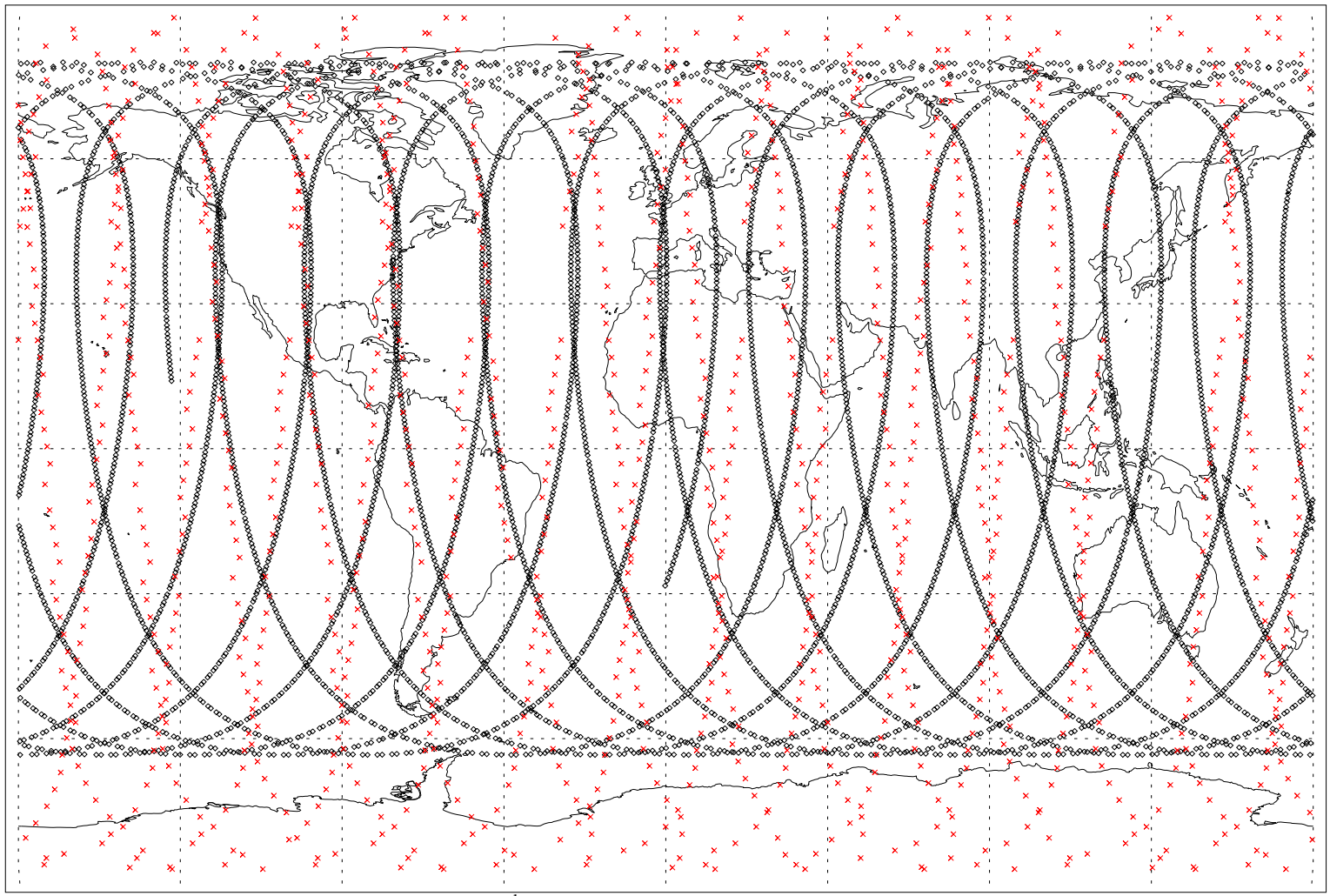


# MIPAS v5.0 and HIRDLS v20408 H2O

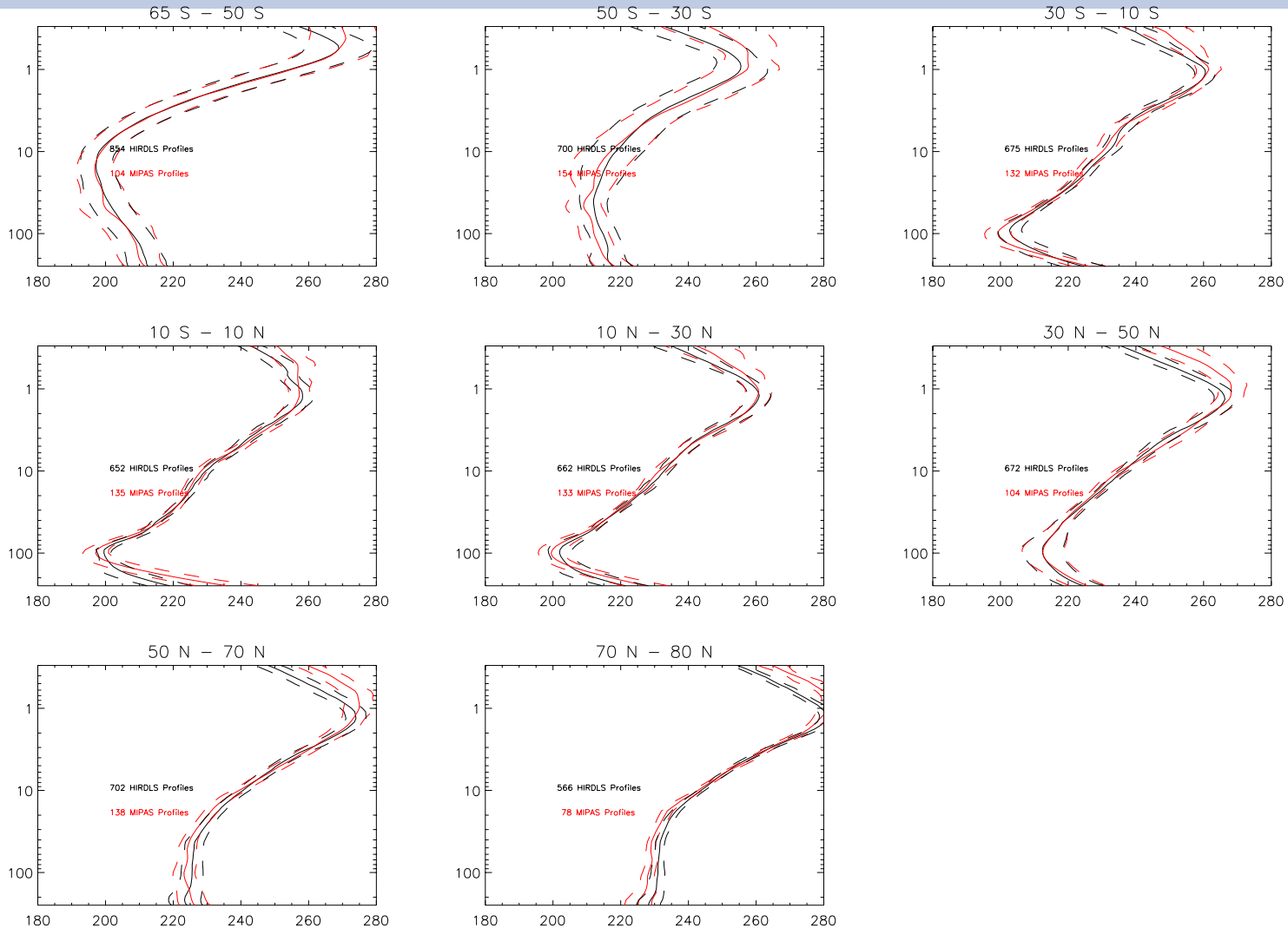


# MIPAS (Oxf) and HIRDLS v20408

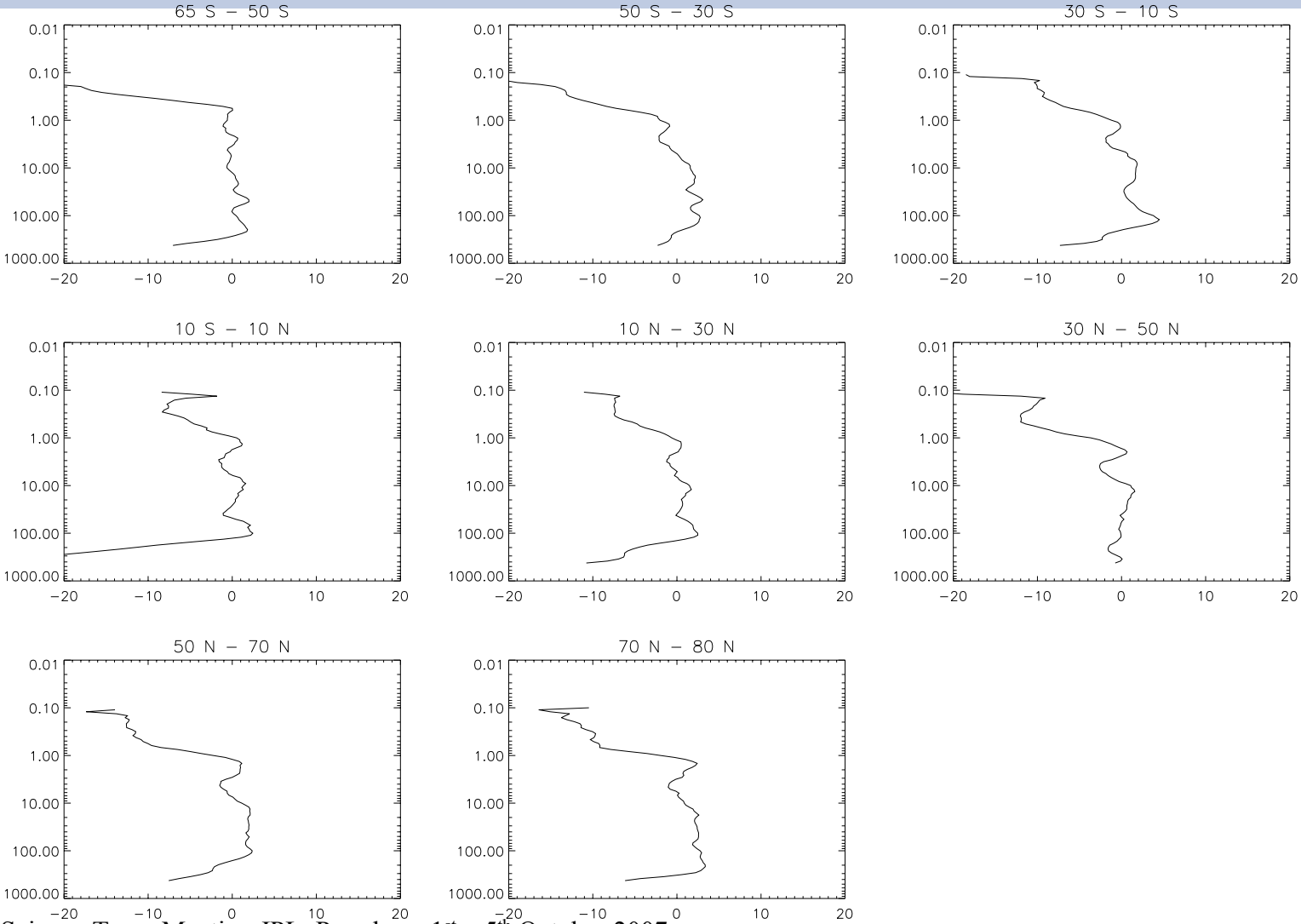
2006d194 (20060713) HIRDLS & MIPAS profile locations



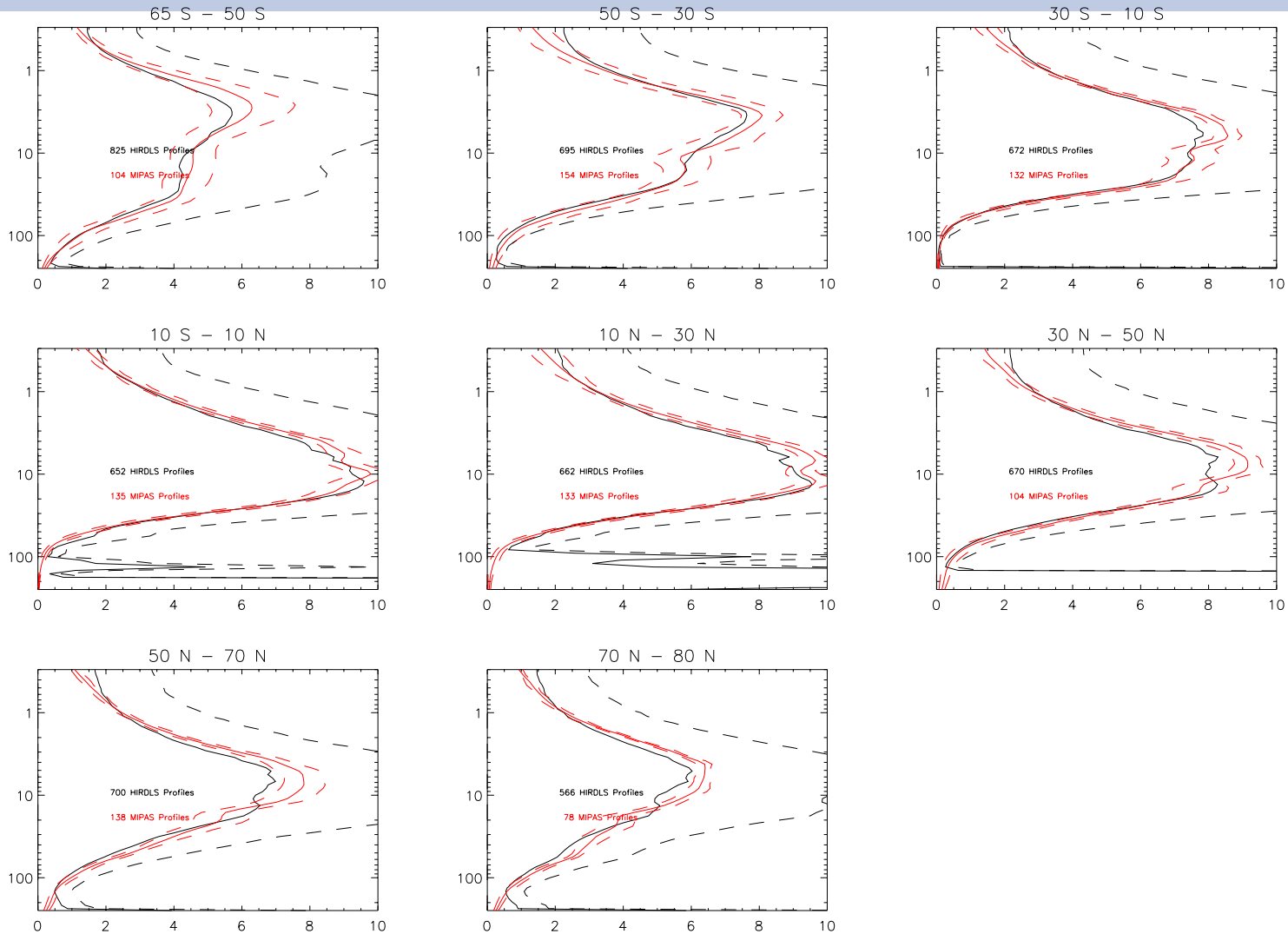
# MIPAS (Oxf) and HIRDLS v20408 Temperature



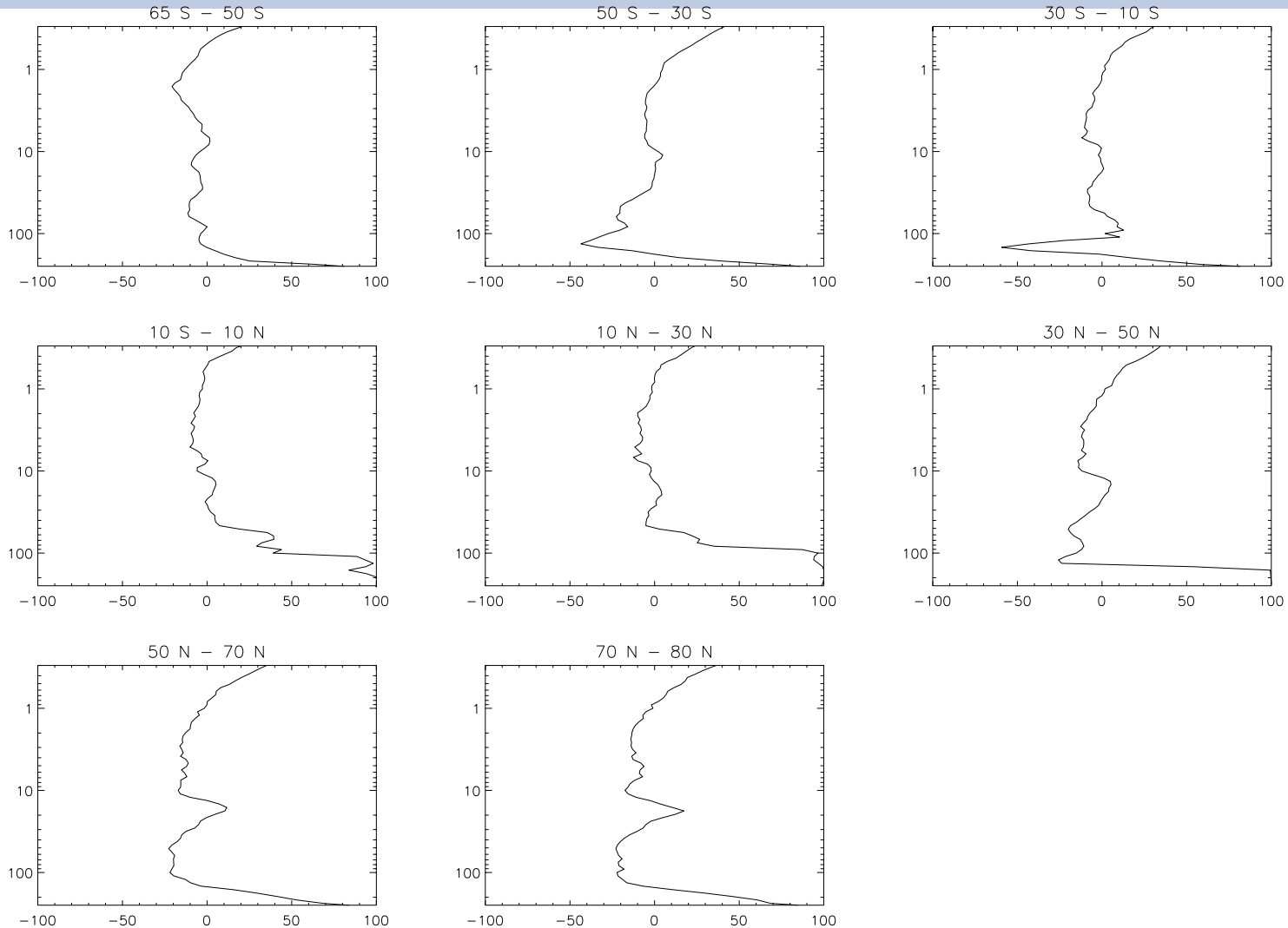
# MIPAS (Oxf) and HIRDLS v20408 Temperature (difference of the mean)



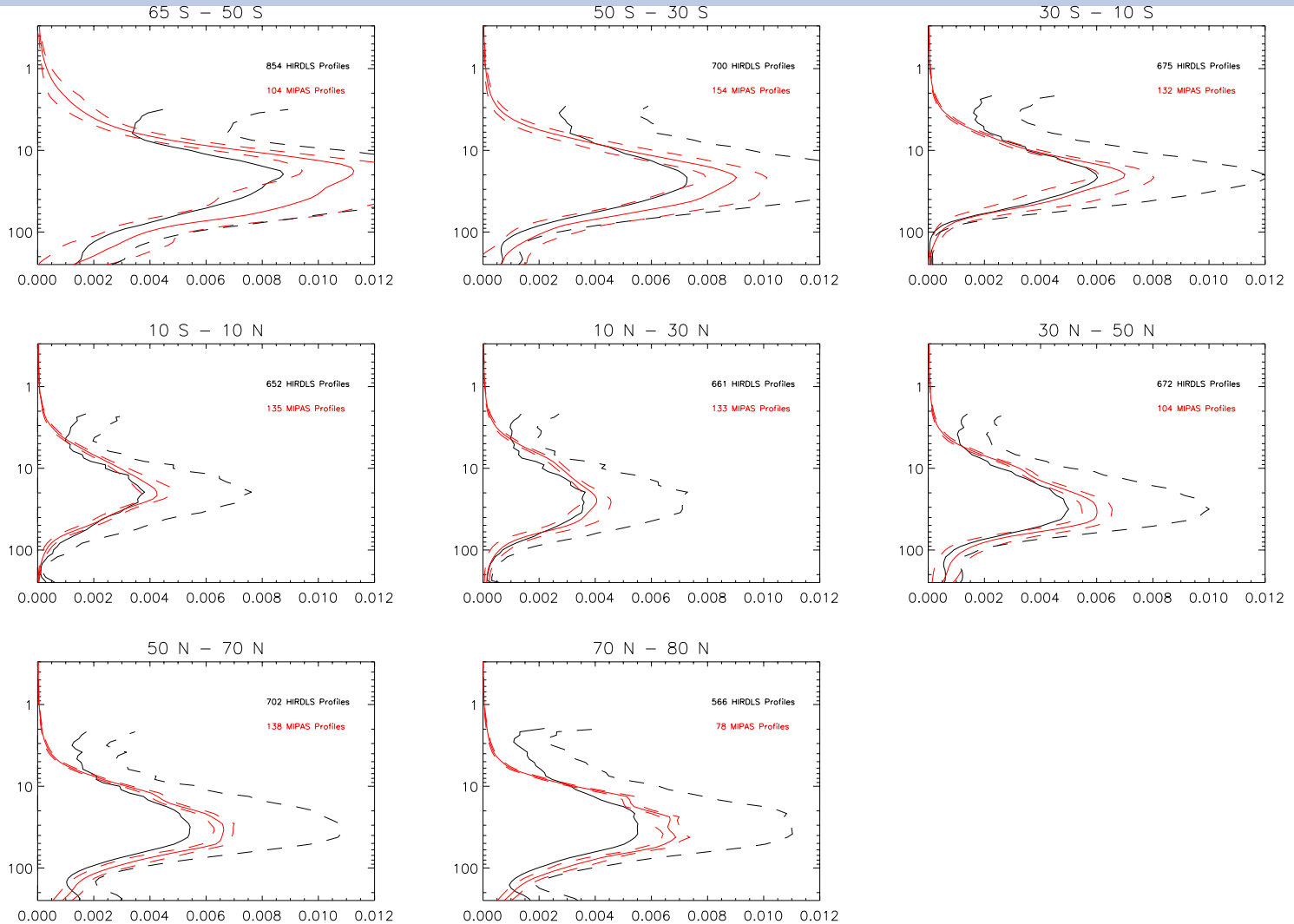
# MIPAS (Oxf) and HIRDLS v20408 Ozone



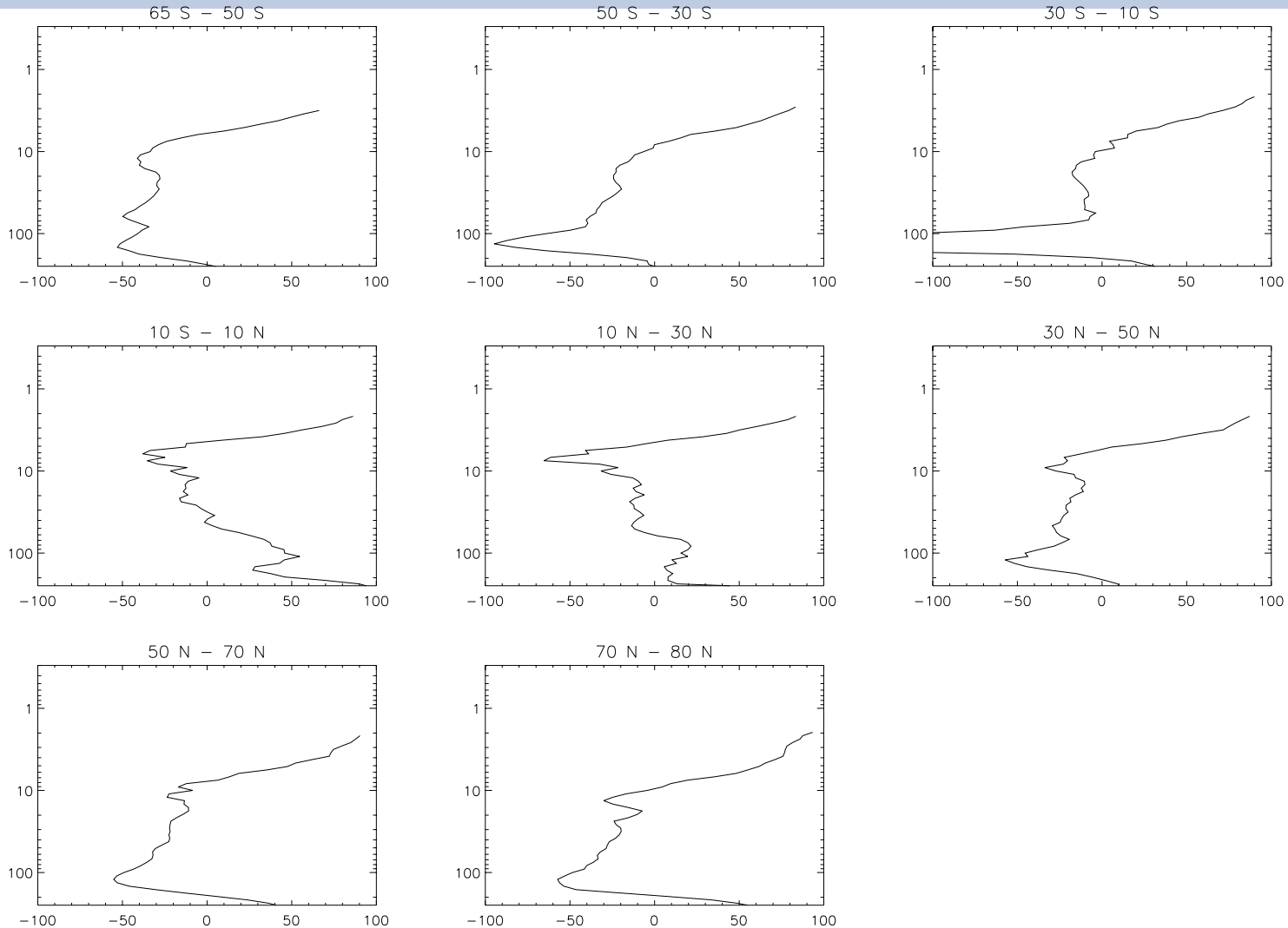
# MIPAS (Oxf) and HIRDLS v20408 Ozone (Difference of the mean)



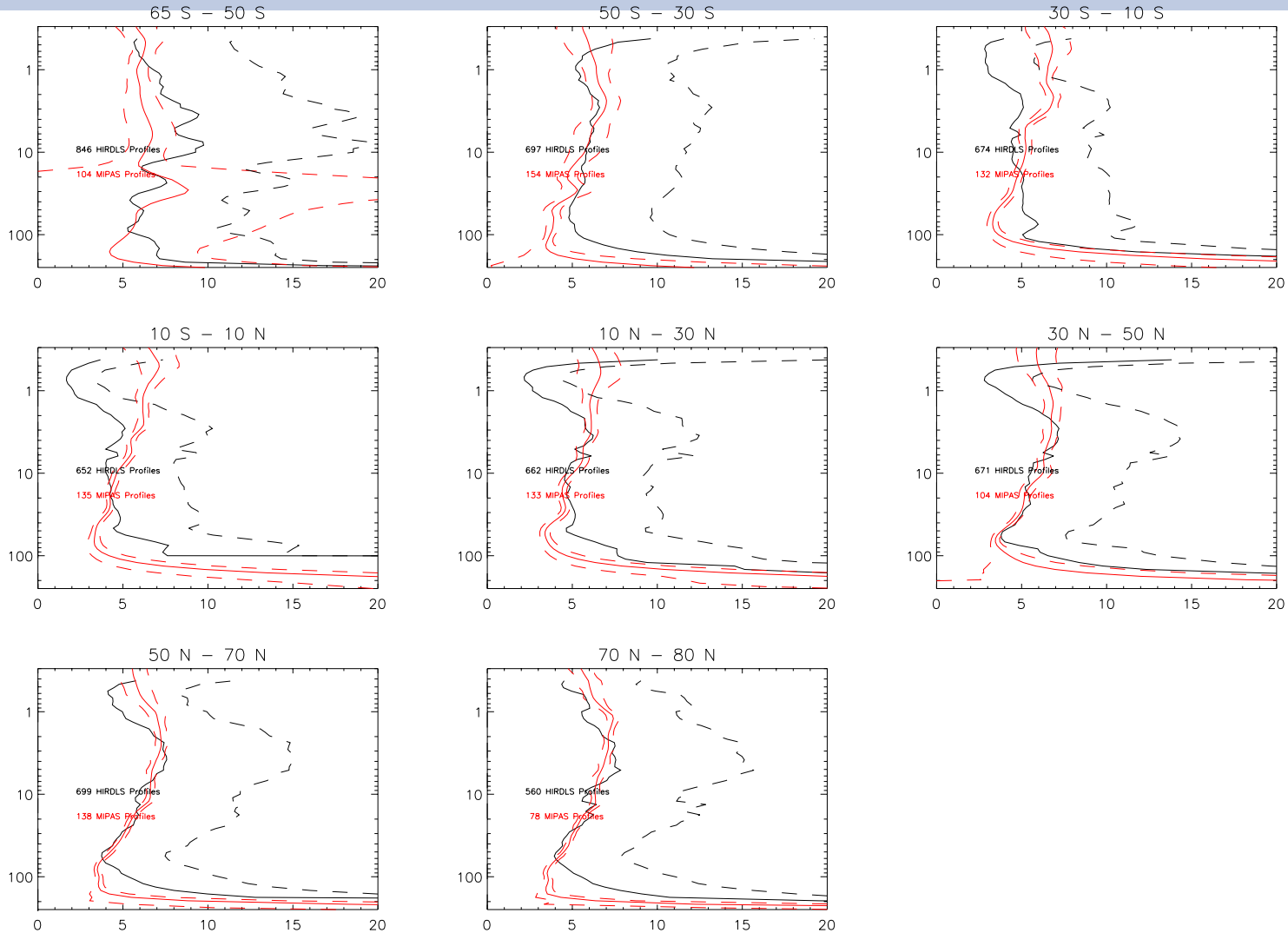
# MIPAS (Oxf) and HIRDLS v20408 HNO3



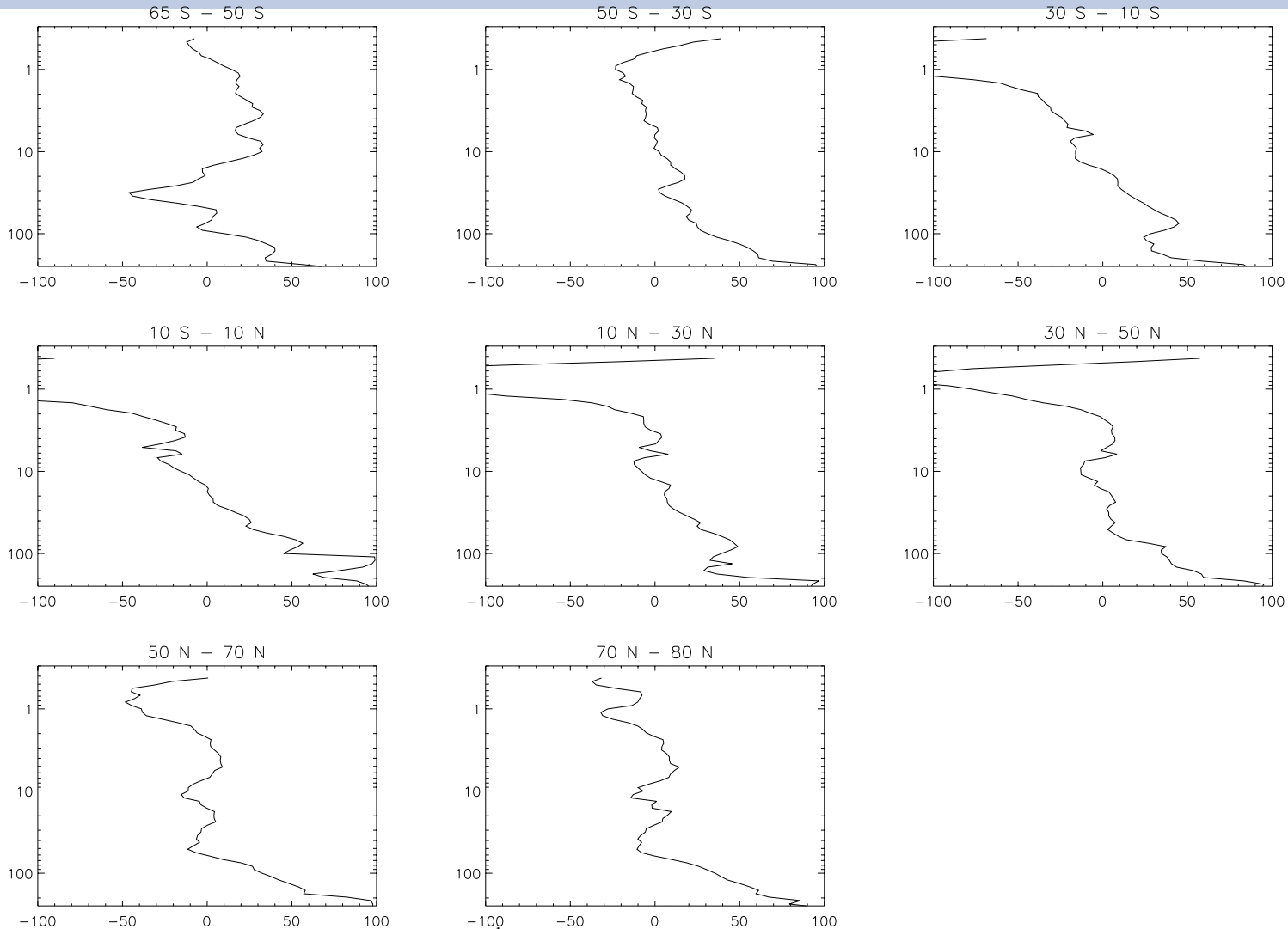
# MIPAS (Oxf) and HIRDLS v20408 HNO3 (difference of the mean)



# MIPAS (Oxf) and HIRDLS v20408 H2O



# MIPAS (Oxf) and HIRDLS v20408 H2O (Difference of the mean)



# Last Page

- **Conclusions**
  - **Results presented here form a small part of the complete validation effort for HIRDLS, from the totality of those efforts it has been agreed that the HIRDLS products, T, O3, HNO3 are of sufficient quality for scientific investigation.**
  - **These species do exhibit an orbit (latitude) dependent bias compared with MIPAS whose origin is quite well understood. Within most of the stratosphere the bias errors for Temp, and Ozone are particularly small.**
  - **The other species are still in work.**
- **Further work:**
  - **Triple coincidence with COSMIC (temp) &c.**
  - **Spatial and temporal morphology.**
  - **Support on-going refinement of HIRDLS correction algorithms.**
  - **Include further allowances for different viewing geometries of HIRDLS and MIPAS.**